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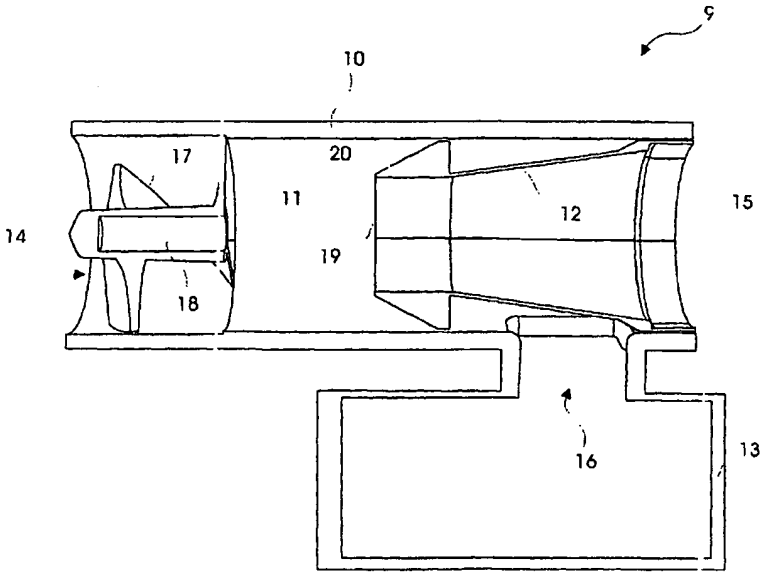
(54) Title: A CYCLONE SEPARATOR



(57) Abstract: The present invention relates to a cyclone separator (9) used in vacuum cleaners (8) which is placed on the suction path of the vacuum cleaners (8), preferably between an extension pipe (4) and a handle (3) coaxially and which comprises a body (10), a vortex generator (11) placed inside said body (10), by means of which vortices are generated in the suction air by virtue of its geometry; a vortex suppressor (12) also located in the body (10) but at a certain distance from said vortex generator (11), to stop at least partly, the dust particles flowing in together with the suction air; and a dust collecting chamber (13) wherein the dust particles are stopped by the vortex suppressor (12).

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

A CYCLONE SEPARATOR

The present invention relates to cyclone dust separating device, placed on the suction path of a vacuum cleaner, which increases the service life of the dust-collecting bag and filter used in said vacuum cleaner.

The cyclone separators are the most commonly used devices in industrial separation processes, such as for petroleum and cool particle separation, etc., due to their low cost and easy maintenance aspects. The general operational principle of said separators is based on the separation of materials with different properties from each other, by using centrifugal force. They are used in the separation processes of, liquid-liquid, gas-liquid, gas-solid and solid-solid phases.

The cyclone separating devices are used as an independent unit that is placed on the suction path in the vacuum cleaners. In this manner, a fraction of the dust suctioned during the cleaning process of the vacuum cleaner, is separated before the dirt enters the dust-bag or filter and is collected in a dust collecting chamber. Remaining particles are received in the dust-bag and filters. The cyclone separator may be so designed that small or large particles could be separated, depending on the intended use. In cases when small dust particles are separated, the blocking of the dust-bag in a short time, is avoided.

In the UK Patent No. GB2344278, a cyclone dust collecting device placed in a different axis with respect to the extension pipe of the cleaner, is disclosed. This positioning of the cyclone may cause a drop of pressure.

In the International Patent Application, No. WO0049932, a cyclone dust collector placed at the extension pipe, in the same axis with respect to said pipe, is disclosed.

In the European Patent Application No. EP0827710, a cyclone dust collector placed at the extension pipe which may be in the same or in different axes with respect to said pipe, is disclosed.

The object of the present invention is to realize a cyclone separator placed on the suction path and which, by virtue of its geometry and structure, reduces the quantity of dirt collected in the dust-bag and extends the service life of the filter, by separating the small sized particles from the sucked-in air.

The cyclone separator realized in order to attain the object of the present invention has been illustrated in the attached drawings, wherein;

Figure 1, is the schematic view of a vacuum cleaner,
Figure 2, is the schematic view of the cyclone separator,
Figure 3, is the side view of the vortex generator,
Figure 4, is the perspective view of the vortex generator,
Figure 5, is the side view of the vortex suppressor.

The components shown in the drawings have been enumerated as listed below :

1. Vacuum cleaner body
2. Hose
3. Handle
4. Extension pipe
5. Floor cleaning unit
6. Dust bag
7. Filter
8. Vacuum cleaner
9. Cyclone dust separator
10. Cyclone body

11. Vortex generator
12. Vortex suppressor
13. Dust collecting-chamber
14. Air inlet
15. Air outlet
16. Hole
17. Blades
18. Hub
19. Mouth
20. Projection

The vacuum cleaner (8) according to the present invention comprises a main cleaner body (1); a flexible hose (2) preferably made of plastic material, connected to said body (1) and a handle (3) to facilitate the user's gripping; an extension pipe (4) made of metal or rigid plastic material, connected to said handle (3); a floor cleaning-unit (5) connected to one end of the extension pipe (4) for cleaning the rugs and/or hard floor surfaces; a cyclone dust separator (9) located on the suction path of the cleaner, to extract dirt and dust particles from the dirt/dust laden air sucked in through the floor cleaning unit (5); a dust bag (6) wherein the residual dust contained in the sucked-in air and which could not be separated by cyclone separator (9) is collected; and a filter (7) that captures the finest particles in the air.

Said cyclone separator (9) is placed coaxially between any two components located on the suction path, for instance between two extension pipes (4) or between an extension pipe (4) and the handle (3).

Said cyclone separator (9) comprises a cyclone body (10); a vortex generator (11) placed in said cyclone body (10) and which creates vortices in the generally uniform flow of sucked-in air by means of its geometry; a vortex suppressor (12) located in the body (10) at a certain distance from the vortex generator (11) for

stopping the the dust particles contained in the sucked-in air; and a dust collecting chamber (13).

The body (10) preferably has a cylindrical structure, comprising an inlet (14), an outlet (15) and a hole (16) opening to the dust collecting chamber (13). The vortex generator (11) is placed in the body (10) after the air inlet (14); and a vortex suppressor (12) is located after the vortex generator (11), which is followed by the air outlet (15). Said hole (16) is placed under the vortex suppressor (12).

Said vortex generator (11) comprises a hub (18) and one or more blades (17) arranged around the hub (18). Vortices are created when the laminar flow of suction air hits against said blades (17).

Said vortex suppressor (12) is located inside the body (10), after the vortex generator (11) and before the air outlet (15); it has a conical structure, the width of which increases from the vortex generator (11) to the air outlet (15). An opening (19), through which the suction air passes, is provided on the vortex suppressor (12) at a section close to the vortex generator (11). One or more projections (20), by means of which the dust particles carried-in by the flowing suction air are stopped as the result of the impact of the vortices, are provided on the vortex suppressor (12) at a section close to the opening (19).

When the vacuum cleaner (8) is operated, the air sucked-in through the floor cleaning unit (5), is directed towards the cyclone separator (9), and vortices are formed by the vortex generator (11) in the air entrained through the air inlet (14) flowing with a generally laminar flow. Said vortex generator (11), by virtue of its geometry, provides the flow of the suction air over the blades (17) without any separation and whereby the suction air gains a speed vector in the radial direction. Due to this structure, while relatively larger particles with low concentration flow close to the axis of said body (10), relatively smaller particles are pushed towards the body (10) inner wall and flow close to the inner walls. The larger dust

particles at the center of the vortex, pass through the opening (19) and reach the air outlet (15) and then are separated by means of the dust bag (6) and the filter (7); whereas the smaller particles collected at the outer sections of the vortex, hit the projections (20) and escape from the effect of the centrifugal force. Said smaller particles, then pass through the hole (16) and are collected in the dust collecting chamber (13) which is in turn, separated from the body in order to remove the dust collected therein. Said dust collecting chamber (13) is re-usable.

In another embodiment of the present invention, the body (10) structure is made of two parts and the distance between the vortex generator (11) and the vortex suppressor (12) can be adjusted by a mechanism placed on the body (10), e.g. by a snap-fitting system providing several steps. In case said distance between the vortex generator (11) and the vortex suppressor (12) is decreased, the amount of dust collected in the dust collecting chamber (13) increases.

In another embodiment of the invention, the amount and dimensions of the dust collected in the dust collecting chamber (13) are determined by changing the width of the vortex suppressor opening (19).

In another embodiment of the invention, the body (10) comprises two parts, the first part being cylindrical and containing the vortex generator (11) and the second part, being adjacent to the first one, having a conical structure.

By providing the cyclone separator (9) the small particles are prevented from entering the dust bag (6) and filter (7), thereby their service lives are increased, which in turn leads to a decrease in the cost of using vacuum cleaner (8).

CLAIMS

1. A cyclone separator (9) placed on the suction path of the vacuum cleaners (8), preferably between an extension pipe (4) and a handle (3) coaxially, which comprises a body (10) with an air inlet (14) and an air outlet (15); a vortex generator (11) placed inside said body (10), by means of which vortices are generated in the suction air by virtue of its geometry; a vortex suppressor (12) also located in the body (10) but at a certain distance from said vortex generator (11), to stop at least partly, the dust particles flowing in together with the suction air; and a dust collecting chamber (13) wherein the dust particles are stopped by the vortex suppressor (12) are collected; characterized with the vortex suppresser (12) placed in the body (10) after the vortex generator (11) and before the air outlet (15), which has a conical structure the width of which increases from the vortex generator (11) to the air outlet (15), with an opening (19), through which the suction air passes, provided on the vortex suppressor (12) at a section close to the vortex generator (11) and also comprising one or more projections (20), by means of which the dust particles carried-in by the flowing suction air are stopped as the result of the impact of the vortices, are provided on the vortex suppressor (12) at a section close to the opening (19).

2. A cyclone separator (9) as defined in Claim 1, characterized with the vortex generator (11) comprising a hub (18) and one or more blades (17) arranged around the hub (18), which provides the flow of the suction air over the blades (17) without any separation and whereby the suction air gains a speed vector in the radial direction and thus due to this structure, while relatively larger particles with low concentration flow close to the axis of said body (10), relatively smaller particles are pushed towards the body (10) inner wall and flow close to the inner walls.

3. A cyclone separator (9) as defined in Claims 1 and 2 characterized with a mechanism placed on the body (10) to adjust the distance between the vortex generator (11) and the vortex suppressor (12).

4. A cyclone separator (9) as defined in Claims 1 and 2 characterized with the vortex suppressor (12) wherein the width of its opening (19) can be adjusted.

Figure 1

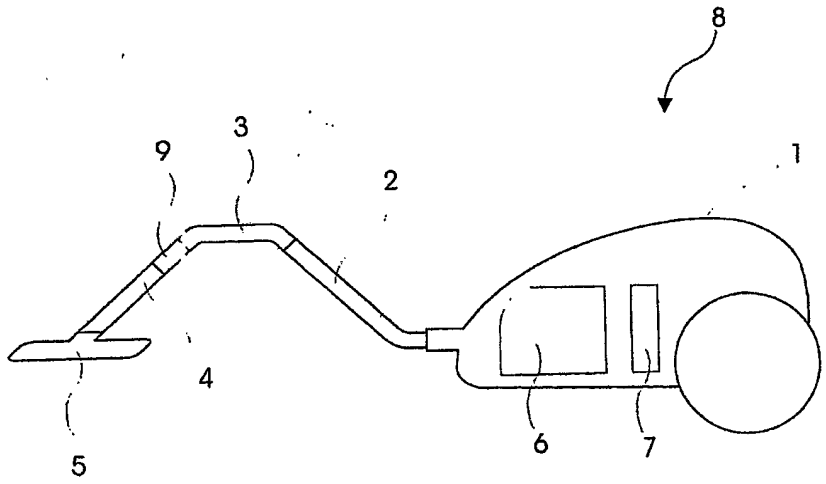

Figure 2

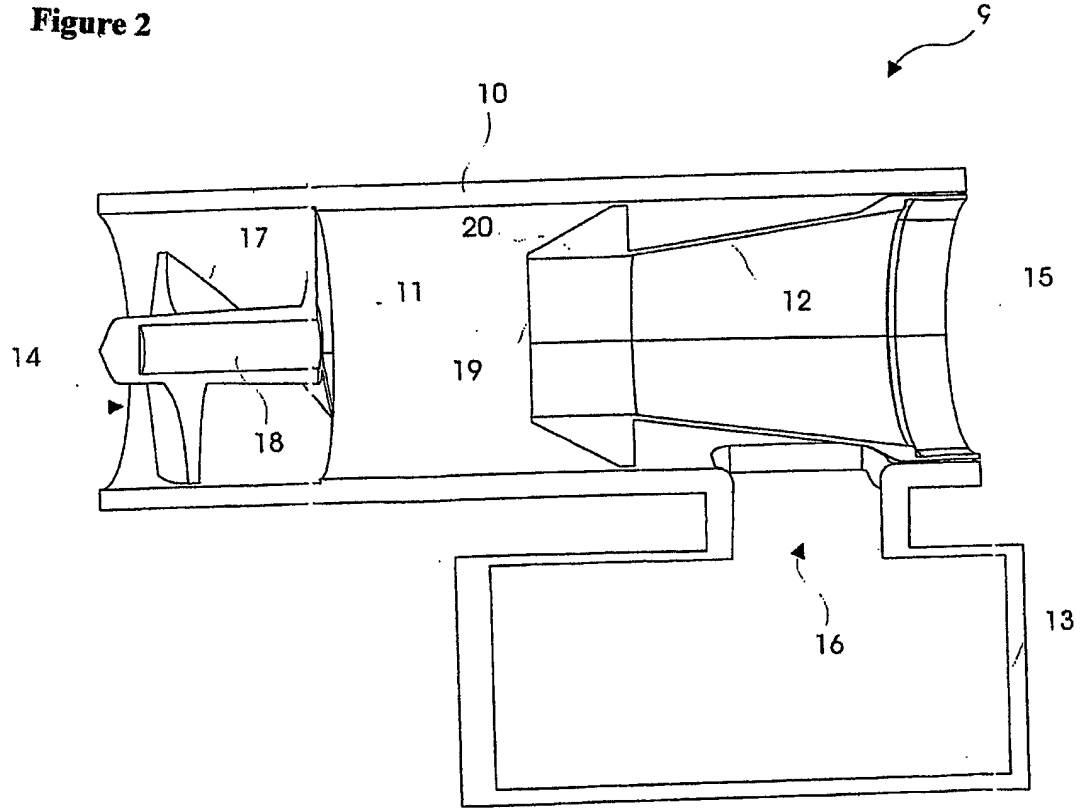

Figure 3

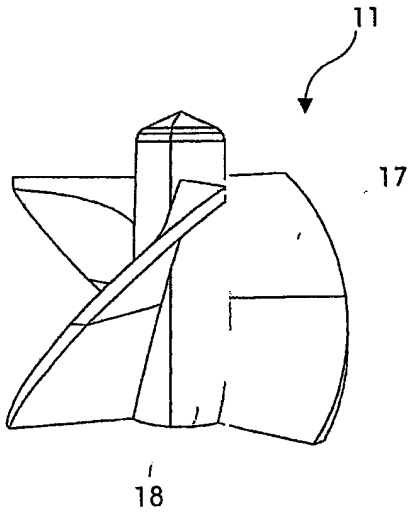

Figure 4

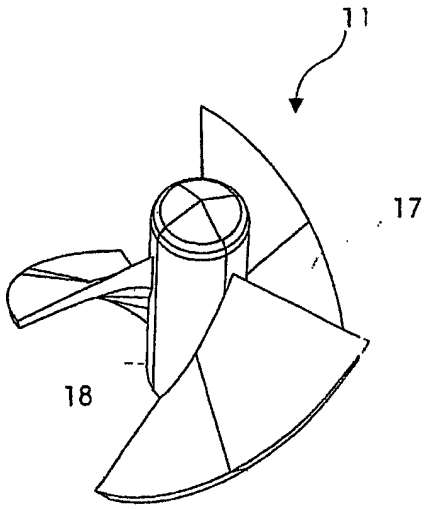

Figure 5